

Attorney's Docket No.: 06816-065002

Amendments to the Specification:

1. Please replace the paragraph beginning at page 3, line 17 with the following amended paragraph:

The art responded by forming multi-quantum well structures (MQW) made of large band gap semiconductors. Positions of the energy levels in an MQW structure are primarily determined by the well height and width. For example, the energy level separation ~~and the depth~~ of the quantum well ~~[[are]]~~ is increased as the thickness of the GaAs layer is decreased. The well's height also depends on the band gap of the Al_xGa_{1-x}As layer and the relative proportions of Al and Ga ("x") in the Al_xGa_{1-x}As. The intersubband energy, i.e., the energy between the ground state E₁ and the first excited state, defines many of the essential characteristics of the quantum well.

2. Please replace the paragraph beginning at page 5, line 3 with the following amended paragraph:

The intersubband system shown in Figure 1 promotes the electrons between subbands -- here from one subband 101 to another subband 106. Intersubband transitions operate between confined energy states, i.e., quantum wells associated with either the conduction band 132 or valence band 130 in the quantum well. The promotion is effective at holes ~~[[100]]~~ in the quantum well.

3. Please replace the paragraph beginning at page 5, line 3 with the following amended paragraph:

However, since the excited bound level is within the quantum well, the photoexcited electrons escape from the well by quantum mechanical tunneling shown as 230. The resistance against particle tunneling is inversely and exponentially

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proportional to the distance through which a particle needs to tunnel. The number of particles which will tunnel through a barrier is inversely exponentially proportional to the thickness of that barrier. Most particles will easily tunnel through a barrier that is less than 50Å in thickness. However, only some particles will tunnel through a barrier between 50 and 100Å, and any barrier greater than 100Å in thickness presents a formidable challenge for tunneling. ~~The tunneling for a bound-to-bound transition has typically more than 100 Å, and hence many~~ Many of the electrons do not tunnel in this way. Therefore, while the dark current in the bound-to-bound photodetectors is low, the photocurrent has also been low because of the tunneling.

4. Please replace the paragraph beginning at page 8, line 17 with the following amended paragraph:

The level of the bound particles in QWIPs are dependent on characteristics of the QWIP materials. One prior art attempt to increase signal to noise ratio involved reducing the thickness of the GaAs layer in the Figure 1 system to thereby elevate the excited state energy level into the continuum level. This intersubband configuration has been called "bound-to-continuum." The photoelectrons are ~~[[bound]]~~ excited into the continuum level, so the photoexcited electrons can escape from the quantum well to the continuum transport without tunneling as shown by 254 in Figure 2. Hence more of the photoelectrons can escape as photocurrent, increasing the signal S. However, since the EP 250 for this detector is less than the ED 252, the electrons are very energetic. This configuration hence has a very low barrier against dark current through thermionic emission. The energy barrier for thermionic emission (ET) is ten to fifteen meV smaller than the energy required for the intersubband

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photoionization process. Accordingly, this configuration has higher noise N relative to the bound-to-bound system.

5. Please replace the paragraph beginning at page 10, line 23 with the following amended paragraph:

The [[quantum's]] depth and thickness of the quantum well are modified so that the first excited state is resonant with (i.e., has substantially the same energy as) a portion of the "bottom" (i.e., the lower energy barrier) of the quantum well. The energy barrier for thermionic emission is thus substantially equal to the energy required for intersubband absorption. Increasing the energy barrier in this way significantly reduces dark current while the photocurrent generated by the quantum well is maintained at a high level

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